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NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS.

TECHNICAL MEMORANDUM

119

BEACON LIGHTS FOR AIR TRAFFIC.

Translated from "Illustrierte Flug-Welt,"
November 24, 1920.

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Advisory Committee
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NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS
1724 F STREET, N.W.,
WASHINGTON 25, D.C.

July, 1922.

BEACON LIGHTS FOR AIR TRAFFIC.*

Only night flying will enable transportation by air actually to compete with other means of transportation, and therefore, in the establishment of new flying fields, or in the improvement of the few which have not been condemned to destruction under the provisions of the treaty of Versailles, great attention should be given to a system of illumination and marking which shall be beyond criticism, in order to render night landing as safe as it possibly can be made. Favored by the victorious outcome of the war, England, France, and the United States of America, which already are providing for a well-regulated air transport system, were able to take the lead in pioneer work in this field by the establishment of first-class fields for night flying, although indications are again evident of a revival in our antiquated flying fields, and the well-known Bremen airport project, which promises to become one on the largest scale anywhere, will be able to serve as a model for new undertakings in the future.

The principal requirement for the safety of future air traffic, safe landing at night, our industry is probably in a position to meet, by putting on the market products already tested in the war.

The following demands must be completely satisfied for night landing: beacon lights to steer by, landing lights and searchlights; and, in addition, lighthouses to designate locations and routes, landing lights on aircraft, apparatus for lighting places where work is done (airports, and airplane and airship hangars), and alarm signals.

* Translated from "Illustrierte Flug-Welt," Nov. 24, 1920, pp. 598 and 599. By Wright Aeronautical Corporation.

Locating the flying field or some other point to steer by at night, requires a powerful, luminous signal, in order to indicate to the aviator, while he is still at a great distance, where his destination is.

The flashing light shown, of the Julius Pintsch Company, Berlin O., with a rotating mirror, is a beacon light for a landing place, which in use has proved excellent. The essential optical element is a polished Fresnel searchlight lens of 150 mm. (6 in.) focal length and 630 mm. (25 in.) diameter, in the focus of which a half-watt metal filament lamp, of special design, of about 4000 candle power, is placed. The rays of light emitted by this and collected by the searchlight lens are directed downwards in a parallel beam on a deflecting mirror which turns on a vertical axis. The beam, which is reflected by the deflecting mirror so as to be compact and sharp in the horizontal plane and widely spread out upward in the vertical plane, undergoes a complete rotation in a definite time, three seconds, for example, so that at any place in the region lighted, a flash of light is visible to an observer every three seconds. If now the light is darkened by interposed shutters for a whole revolution, and is unobstructed again for shorter or longer intervals, then in this way a number of signals may be made. This beacon has a horizontal intensity of about 500,000 candle power, and is visible at about 80 km. (50 mi.), according to atmospheric conditions.

The constantly increasing demands for lights of greater power

led to the construction of beacon lights of an entirely new kind on the basis of the following considerations.

Experience has demonstrated that the radius of visibility of a source of light increases with the size of the luminous body, because in this the so-called "eye-angle" of the rays of light from the edges plays an important part.

Since the production of large luminous areas is involved in difficulties, a solution has been found in so-called multiple lamp beacons, in which rather large numbers of sources of light are distributed over considerable areas. These requirements are met by the Pintsch beacon light (see attached illustration), with egg-shaped lamps. Each of the 96 special lamps has a spiral metal filament and is silvered on half the circumference. Without the optical effect of the silvering, the lamp has a candle power of 50. Because of the special shape and the silvering of the Pintsch egg-shaped lamps, the luminous intensity in a horizontal plane is considerably increased, and amounts to about 400 candle power for each lamp. The total luminous intensity of this beacon light, since half of the 96 lamps are always effective in any direction, measures accordingly more than 19000 candle power. The beacon is visible at 60 to 80 km (35 to 50 mi.), and is provided with a motor-driven switch for flashing or making Morse signals.

Such beacons may be equipped for making Morse or number signals by hand, so that by this means communication with airplanes at great distances is made possible.

In addition to these beacon lights, which serve for steering a course to the flying field, the need has made itself felt for having available for travellers by air further means for making landings at night, once the flying field has been reached, as safe as possible. Efforts to use beacon lights simultaneously for illuminating the landing field have led to no good results, so that a complete departure has been made from this practice. The greatest danger for the aviator lies in his ignorance in being unable to recognize in the darkness where the most favorable spot for a descent is, and in having no knowledge of what the direction of wind is across the landing field. Recognizing this essential condition for air traffic, the Pintsch Company has constructed an installation with landing lights sunk in the ground, which has already conspicuously proved itself. By an arrangement of this kind a certain means is provided for making air travel by night, to which the future belongs, safe in operation and comfortable.

The patented installation consists of nine light containers which are set in the ground on the landing field in a suitable place, corresponding to the cardinal points, so that they do not project above the surface. The arrangement of these light containers, of which one is in the middle and eight are equally separated at a distance of 40 m. (130 ft.), is shown in attached illustration.

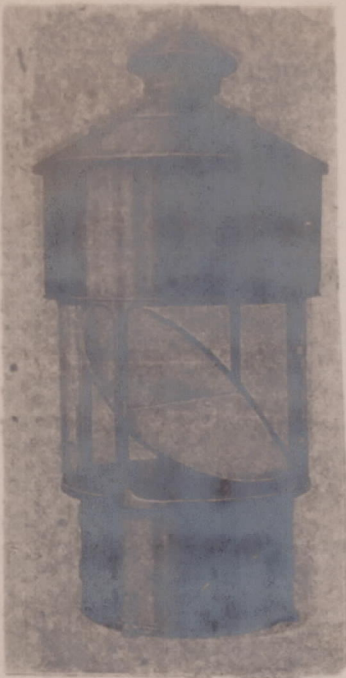
In order to indicate to the aviator the direction of the surface wind, three lights on the outer circle and one opposite, according to the direction of the wind, as well as the one in the

middle, are switched on, so that by these five lights the rough outline of an airplane is represented. On descending, the pilot has only to give his attention to making the position of his airplane correspond with the illuminated outline. In order that the five lights may constantly indicate the correct wind direction, they are in positive electrical connection with a weather vane of special design. To make possible a more exact indication of the direction of the surface wind, thirteen or even more light containers may also be provided; the illuminated outline in this case is still made up of five lights.

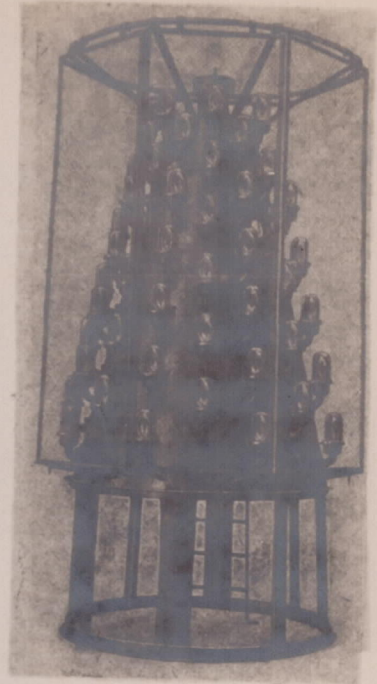
An essential requirement is to have available one or two smaller searchlights to be able to transmit signals to approaching airplanes or to illuminate obstacles in the way of landing. The most useful searchlight for this purpose is probably a P H 50 searchlight with a half-watt lamp, which has a polished glass reflector of an effective diameter of 510 mm. (20 in.), and a focal length of 317 mm. (15 in.). In the operation of this searchlight which has a luminous intensity of about 4000 candle power, no special technical knowledge is required.

The significance of night lighting of our flying fields has now long since been recognized, and improvement in this direction will not be long in coming, since precisely air transport is in a position to fill properly the evident gaps which exist today in our transportation system.

A short reference to beacon lights for designation of localities and routes, as well as to landing lights on airplanes, will be reserved for a later discussion.

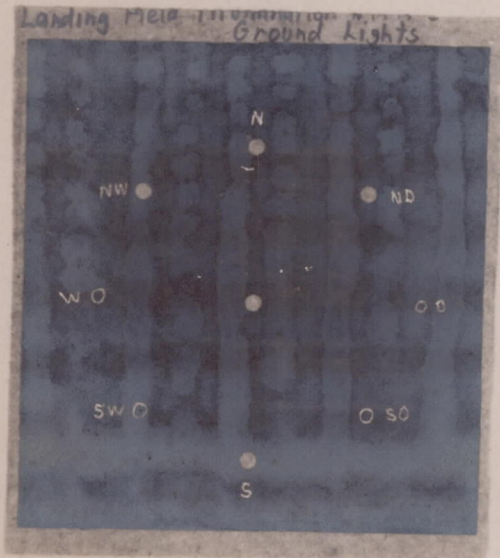


Flashing Beacon Light with Rotating Mirror.

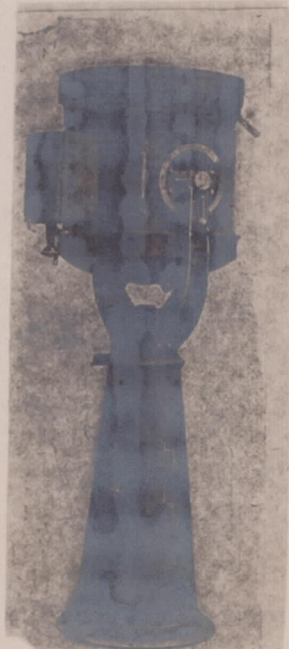


Flashing Light with Egg-shaped Lamps.

Landing Field Illuminated with 9 Ground Lights.



Landing Lights.



Pintch PH 50 Searchlight with Half-Watt Lamp. Heavy Model.